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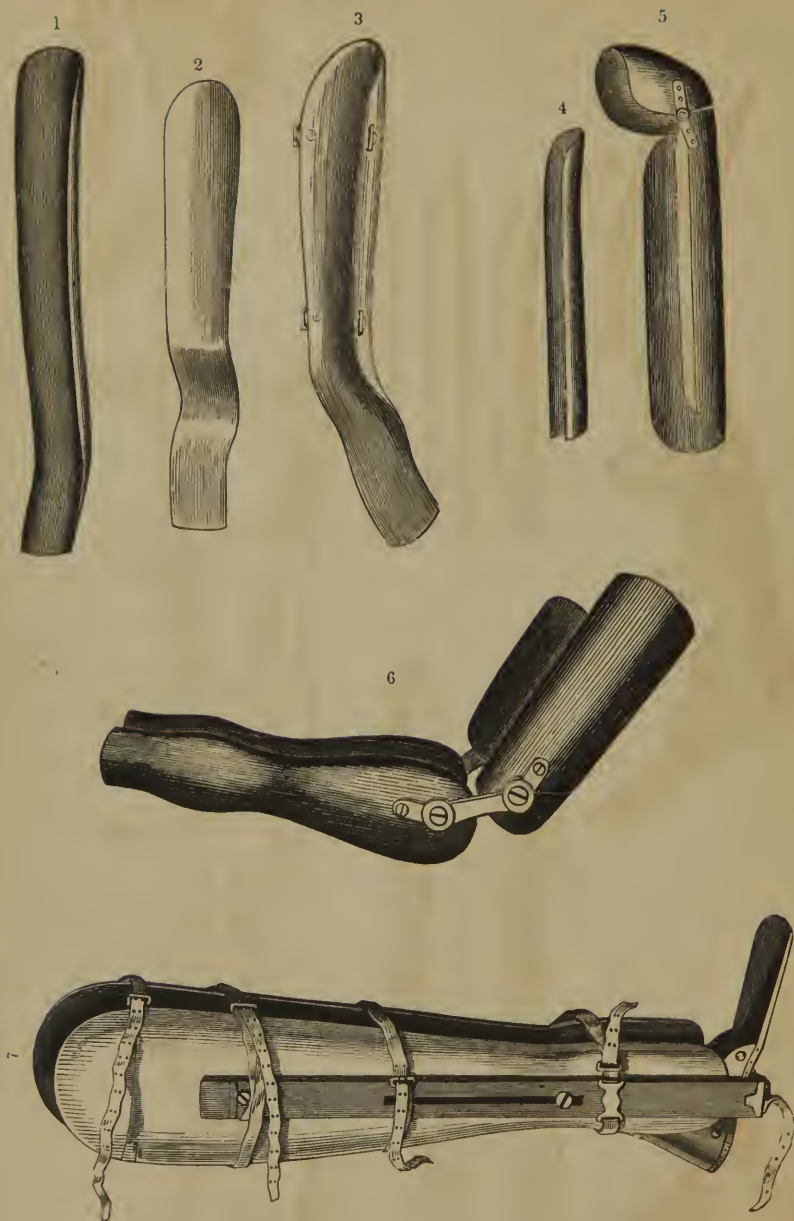
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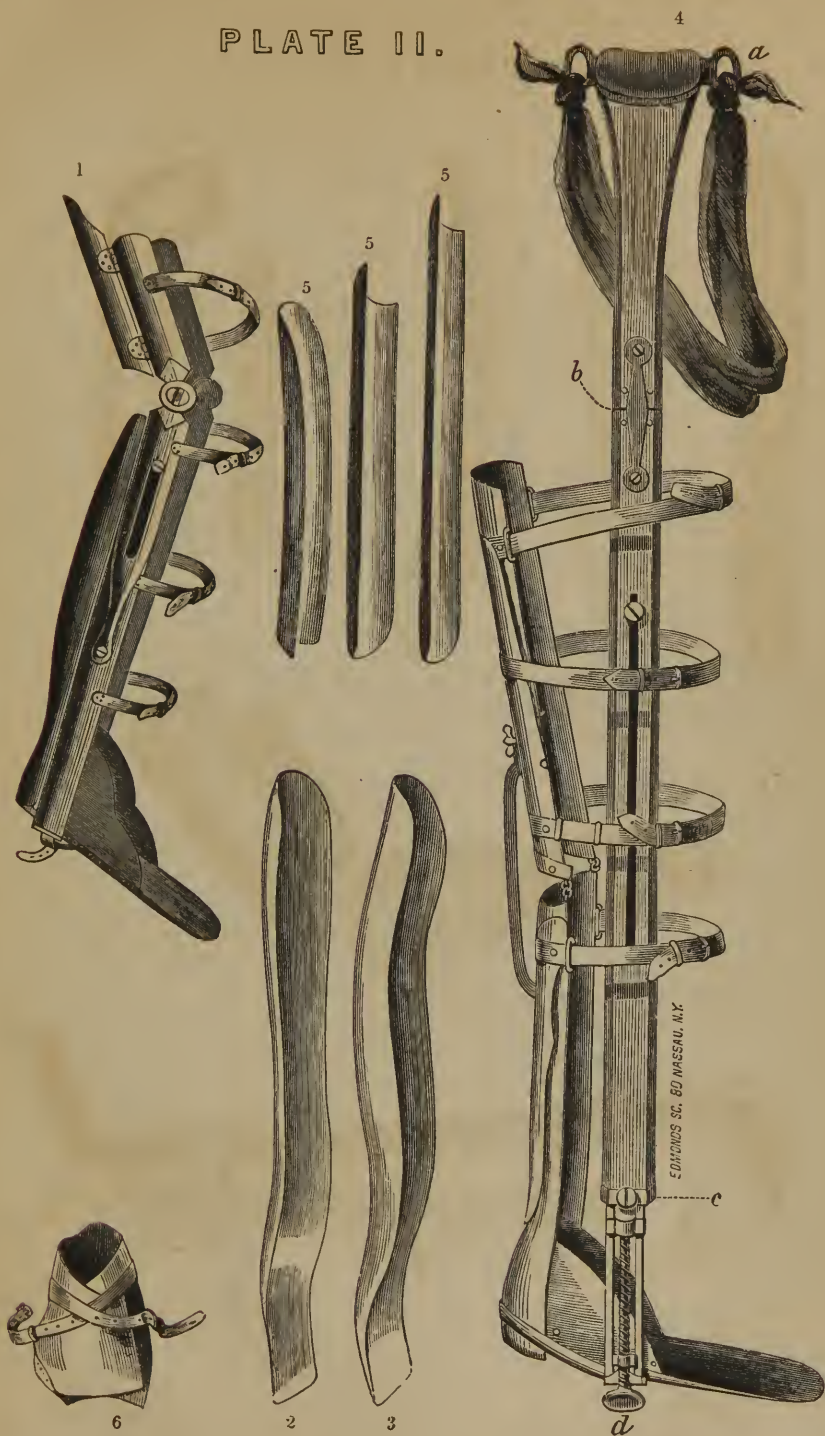


PLATE I.





# PLATE II.





CIRCULAR No. 3.

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# SURGEONS' SPLINTS,

AND

IMPROVED

APPARATUS FOR FRACTURES.

BY

BENJAMIN WELCH, M. D.

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# ADDRESS.

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TO SURGEONS AND PHYSICIANS :

SOME general observations on the principles of treatment in fracture seem necessary, in describing a new form of apparatus for giving mechanical support, that its advantages may be properly estimated, and to direct to the most successful manner of applying it. These observations being entirely practical, and the result, it will be admitted, of not very limited experience, will not, it is hoped, though appearing in the not very inviting form of an advertisement, be found altogether unworthy of consideration, independently of the apparatus they are especially intended to illustrate.

The opinion expressed in a former Circular, that some more available, convenient, and effectual means of giving mechanical support in this important class of injuries, and for maintaining the position of injured or diseased parts, than any before in use, was a desideratum, and would be appreciated by the profession, has been confirmed, and my anticipations of encouragement fully realized.

## On Mechanical Support of the Muscles implicated in Fractures.

The importance of giving support to the Muscles in the treatment of Fractures, to me appears to have been strangely disregarded. This subject was cursorily alluded to in my former Circular, and I propose now to give it more extended, though it must still be limited, consideration.

Absolute rest of all the muscles giving motion to a fractured bone, is demanded. To procure this, the natural longitudinal support afforded by the bones, in a suitable position of the limb, it is

known, is necessary. Their contractile power is excited either by over-extension, or when natural support is withdrawn. Uniform lateral support is no less important, and uniform compression impairs or overcomes the contractile tendency, while unequal pressure is a source of irritation, and excites it. Much has been said and written in relation to the *position* giving the most equal support to the muscles, and, therefore, the most favorable for replacing the bones, and maintaining rest; comparatively very little has been said, and apparently little notice has been taken of the effect of compression, or the lateral support of the muscles, although its influence in subduing contractile power, as a physiological fact, is well known, and may be turned to much practical advantage. Incidentally some lateral support, much even, may be given to the muscles by the ordinary process of bandaging with cushions and splints. This, however, has been applied chiefly with a view to prevent swelling, and as a covering by which the irritation of splints is avoided, and to confine the dressings to the limb, rather than for any other object. The late Prof. Nathan Smith, of New-Haven, directed that in all cases the splints should enclose one-half of the circumference of the fractured limb, while the other half was supported by a bandage. This was, however, with a view to the advantage of a broad surface to give support to the bones, and maintaining coaptation. Similar advantages result from the use of the Gum, Starch, or Dextrine bandages, at one time so popular, and which, in fact, under favorable circumstances, and when skilfully applied, have performed remarkable cures. Notwithstanding all this, the necessity of lateral support of the muscles, with a view to preventing contraction, and to prevent misplacement of the bones, or shortening of the limb, or the spasms, often so troublesome, is nowhere once alluded to in any system of Surgery with which I am acquainted; on the contrary, dressing is often recommended and practised, without any lateral support of the muscles whatever.

As examples of this mode of dressing, I will first mention Fractures of the Femur, a single bone supporting the entire weight of the body in all its movements, surrounded by the most powerful muscles, and where shortening of the limb is the admitted rule, and perfect cures the exception, which is often treated, both in Hospital and private practice, only by the long side-splint,

extending from the axilla, along the side and limb, beyond the foot, for maintaining extension, and the support of the bed on which it rests in an unchangeable position, prescribed by the Surgeon. Prof. W. Gibson recommends the treating of this injury by two long splints, one upon each side of the body, with a cross-piece beyond the feet, to which the feet are confined, for making extension, without the slightest dressing applied to the thigh. (See *Gibson's Surgery*, vol. i., p. 445.) Or the same injury is treated by elevating both feet upon an inclined plane, extending from the hips beyond the feet, with a foot-piece, to which the feet are confined for making extension, and no dressing applied to the thigh. (See p. 450.) James L. Van Ingen's Method, as reported by Prof. Hamilton, in the last volume of Transactions of the American Medical Association, consists in converting the whole bed, upon which the patient rests, into an inclined plane, by elevating the lower bed-posts upon small blocks or bricks, and maintaining extension by confining the foot of the fractured limb to a cross-piece, extending between the posts, and the thigh only supported by cushions underneath. In various contrivances for permanent extension in fractures of the leg, we find the same total neglect of lateral support to the muscles. With proper dressing, in fractures of the leg, permanent extension is certainly seldom, and, we believe, *never* required.

The late Prof. Dudley, of Transylvania University, Kentucky, was the first, and, so far as I am acquainted, is still, the only writer who has given this subject the prominence it demands. He, with the enthusiasm of a *reformer*, goes so far as to recommend, in the treatment of compound fractures, complicated by extensive lacerations and gunshot wounds, to trust solely to the position and the omnipotence of the bandage, of which he has been justly *denominated* "the hero." He tells us not only "*all contraction, but all susceptibility to muscular action, is effectually suspended, by a sheath or case of properly prepared canvas.*"

It is many times recommended to delay the dressing of fractures for several days, placing the limb in an easy position, as it is called, upon a pillow, and enjoining rest until inflammation has subsided: because the pressure of the bandage and splints is supposed to increase it. This is another instance in which the principle we are considering is disregarded; and is nothing less than to delay the

most efficient remedy, both of pain and inflammation, until the most urgent necessity for it is removed. Proper support is a direct means of preventing both inflammation and pain; and if it is delayed under the mistaken idea of avoiding irritation, and, as described by Liston, "no efficient means are employed to prevent the spasmodic action of the muscles, the startings of the limb, the jerkings of the broken ends, and the displacement of the fragments, then, assuredly, in spite of all local and general measures, there will arise frightful swelling, pain, tension, and heat; the inter-muscular tissue will be gorged with blood, and the circulation of the limb roused to a dangerous and alarming degree."

#### Pain and Spasms attending Fractures.

*Pain* or *spasm*, beyond what necessarily attends the injury to the soft parts, is not a necessary condition of the union of fractures. Healthy bone itself is perfectly insensible, and is no more sensible than the soft parts during the process of healing, unless inflamed, when it becomes most exquisitely sensible and painful. In fractures of the superior extremity we seldom hear more complaint than would be expected from the manifest inflammation and injury to the soft parts, without spasm or twitching of the muscles, obviously because the fragments of bone are not allowed to rub upon or irritate each other. But not so in fractures of the leg and thigh. The greater weight of the parts to be supported, and the means of support employed, altogether more inadequate, and the restraint imposed upon the patient being more severe and more imperfectly complied with, and in addition to all this, the dressings such as are used often being unskillfully applied, we should expect involuntary twitchings of the muscles would be excited by the constant irritation; that sleep would be disturbed, and its approach regarded with terror in consequence of the spasms, which only await its approach; that finally, inflammation of the bone itself would be excited, as well as in the surrounding soft parts, so that we should have irritation, fever, pain, such as inflammation of bone only can produce. All this, as an abstract proposition and physiological fact, is well known by the intelligent practitioner, but greatly at variance with popular notions in relation to fractures; and practically, surgeons, I fear, will not be ready, in all cases, to stand manfully to the test, and attribute the pain and



spasmodic twitching of the limbs of their patients to their own defective or unskilful dressing.

### Union of Fractures.

The union of fracture of the bones is the result of the laws of health—healthy action developed in the recuperative power of the animal economy—strong, in proportion as the vital powers are vigorous and healthy—weak, in proportion as they are feeble or disordered.

It hence follows, that all the appliances of art must be wholly powerless in any degree to promote or accelerate the process any further than we can remove hindrances to the development of healthy action.

Thus far I shall not be disputed ; yet the principle seems to be too much lost sight of and neglected in practice. As the obvious effects of this tendency of nature, we have a certain amount of inflammatory action, accompanied by some increase of heat, pain, and swelling of the soft parts. If these fail, the process is interrupted or retarded. On the other hand, these symptoms being in excess, instead of a secretion at first fluid, then fleshy and vascular, then ligamentous and flexible, and finally unyielding bone, we have the common results of high inflammatory excitement, great swelling and pain, and it may be the formation of pus and extensive suppuration or gangrene of the part. Hence indiscriminate flooding by wet applications, and by cold, or unnecessarily encumbering the parts, and increasing heat by a multitude of cushions and bandages, cannot but be highly injurious and censurable.

Another point to which I especially wish to draw attention : as the process is a natural one, so also nature has established a period for the accomplishment of her purposes, which must, while the laws of the animal economy remain the same, remain unalterable. We do not, therefore, expect to expedite the process beyond what is already known as the period of health. On the contrary, by the perfection of our instruments we may even retard union ; and not unfrequently the most perfect cure is rather slow in its accomplishment. Let there be some imperfection in the adjustment of the bones—let there be some irritation in consequence of imperfect support of the parts, there will be an exuberant and



rapid growth of callous—a large ridge may be formed around the place of fracture, it becomes quickly solid, and the patient has the use of his limb, it may be somewhat deformed, but still quickly restored.

Bearing these principles in mind, we are at no loss in accounting for an admitted fact, that bones of the superior extremity usually heal much more rapidly than those of the inferior; for there is less of absolute restraint, less to impair the energies of healthy action, and all the processes of health are more fully sustained. The ribs, when fractured, though never at rest, heal with remarkable rapidity. So also with the bones of animals: the animal limping and deformed, yet the bones solid and healed in a remarkable short space of time. The very obvious import of this is an important practical lesson; that is, in all cases, allow as much motion and general exercise as is consistent with the paramount objects of exact coaptation of the bones, and safety as regards the reproduction of the fracture.

#### Un-united or Tardy Union of Fractures.

This apparatus, on account of its lightness, and being accurately fitted to the limb, is peculiarly adapted to Amesbury's method of promoting union, by compression in both the lateral and longitudinal direction of the bones, by which absorption of the perhaps superabundant soft and yielding substance which has accumulated between the fragments of bone is promoted, a degree of healthy action excited, and soon bony matter deposited, and finally solid union produced.

Such, I can confidently assert, from repeated trials, will be the result in most of what may be termed recent cases. I believe very few if any cases of not more than ninety days' duration will be found to resist this method of treatment. I have met with none. Perhaps not the least efficacious part of the treatment consists in allowing a very considerable amount of bodily exercise, without endangering a reproduction of the fracture.

The system has become debilitated by long confinement—vascular action in the affected limb is especially weak—when suffered to remain in a depending position it becomes livid—when blood is pressed from the capillaries by the finger, it is slow in returning; but by resuming, as the patient may now be allowed to do, some

general exercise, such as hopping on crutches, riding, or, if no more, than sitting up and removing from the bed to the chair, with friction, showering, stimulating lotions, &c., to the limb, health improves, circulation becomes more vigorous, the bones evidently become more unyielding, and soon union is complete.

### Conditions other than Fractures requiring Splints.

These are sprains, inflamed joints, rheumatism and wounds, either incised, contused, or lacerated, extending to muscles, tendons, or joints. To describe all these cases particularly, would exceed my limits, and is not necessary. These splints are well adapted to all such cases, and there can be no doubt that the advantages of mechanical support have been strangely overlooked, since motion and the separation of divided parts are in all cases the principal obstacles to union.

In cellular and muscular structures, this especially holds true—*perfect apposition or contact, and perfect rest, in the healthy constitution, are the only conditions required for union by first intention.* If means to diminish inflammatory action are required, as washes or wet applications, it is because there exists partial disorganization in consequence of contusions, or too much heat is excited by improper dressings or other applications, or excessive general excitement or feverish action exists in the system.

Incised wounds of the knee or other joints, which are justly regarded with terror, and are in a high degree dangerous if neglected, heal with the same, or perhaps I should say, almost the same, certainty as wounds of other parts, if the conditions above stated are strictly complied with.

B. WELCH.

LAKEVILLE (*Salisbury*), Conn., Feb. 1, 1858.

### Apparatus Described.

The splints consist of light and elastic cases or coverings, formed of very thin strata or layers of wood or "cut veneers," cemented together by interlayers of gutta percha, of such thickness as is required to maintain their form, and pressed into the form of the part for which they are designed. By this method of constructing splints, the fibres of the wood all run longitudinally or parallel with the surface, which gives them great superiority to

splints carved from solid blocks of wood, however skilfully performed and fitted to the part. For when so thin as to be elastic, they are necessarily liable to split and break, and do not retain their form when wet.

Gutta Percha used by itself, was at one time supposed to constitute the *ne plus ultra* as a dressing for fractures, on account of its perfect plasticity and strength, and resistance to the action of fluids; but experience soon demonstrated that it had not sufficient firmness at the temperature of the body, to resist the pressure to which it was exposed.

This may be introduced in any proportion required to give strength and durability and resistance to the action of fluids, and, when properly applied, it adheres with more firmness to the wood than the fibres of the wood do to themselves. Another circumstance attending this arrangement, of considerable practical importance is, that the splints are made more flexible and elastic in the lateral or parallel direction of the fibres of the wood, than in the longitudinal; hence, what may seem somewhat paradoxical, they readily accommodate themselves to changes in the dimensions of the limb, resulting from increase or diminution of inflammation, or from interstitial absorption, while they give perfect support to the injured or diseased part. When necessary to adapt them to limbs of individuals differing in the form and size of their limbs, they are made sufficiently flexible by immersion in hot water, or simply enveloping the splint, or such portion of it as may be necessary, in cloths wetted with hot water for a few minutes, and then, on cooling, they will immediately become unyielding and elastic as before. This peculiarity can scarcely be too highly appreciated, for of all the materials heretofore proposed capable of being moulded to the part and hardening after the splints are applied, none has been found which has not proved decidedly defective in practice. They possess great strength and durability, so that the same splint may be used a long time, and for the treatment of many cases of fracture. They do not preclude the use of evaporating lotions, water-dressings, or moisture in any manner applied, except when heated much above the temperature of the body. They are applied with great facility, rendering the dressings simple and easy to both surgeon and patient, and allow constant access to the injured part, to detect inflammation at its commencement, or

any irregularity in the position of the bones ; and after the tendency to inflammation has subsided, dressing or examination by the surgeon is required much less frequently than when ordinary splints are used. In short, they have, combined with the property of being made sufficiently soft and yielding to be moulded, with accuracy, to the surface of the part for which they are designed, all the properties of insolubility, lightness, elasticity, strength, and firmness, necessary to constitute a *perfect Splint*.

In connection with the above splints is apparatus for maintaining permanent extension in fractures of the thigh, and for fixing the joints of both the superior and inferior extremities in the extended position, or at any degree of flexion of the limb required. These will be described with the consideration of particular injuries.

The entire apparatus is made with especial reference to allaying the tedium of confinement consequent to fractures, by allowing changes of position and exercise, not inconsistent with the perfect quiet of the particular muscles implicated in the injury, and allowing such removals as circumstances often imperiously demand, as when persons are injured at a distance from their homes ; and this will not be found so inconsistent with the greatest success in the treatment as has been generally supposed, for the more complete the support given, and the more perfectly the action of the muscles is suppressed, the greater may be the amount of general exercise without deranging the fracture.



## EXPLANATION OF THE PLATES.

The Plates I and II (fronting title page) represent cases or sets of splints and apparatus, described in the following pages, adapted to the treatment of all fractures of the extremities.

### PLATE I.

#### SPLINTS FOR THE SUPERIOR EXTREMITY.

Fig. 1. " Dorsal Forearm Splint."

Fitted to the dorsal side of the Forearm.

Fig. 2. "Palmar Forearm Splint."

Fitted to the palmar side of the Forearm.

Fig. 3. "Wrist Splint (right and left)."

Fitted to the palmar side of the right and left forearm and hand—the hand being strongly flexed outward. This splint is for the treatment of fracture of the radius near the wrist, or dislocation of the ulna at the inferior extremity, or both combined.

Of each of the above splints, in each case, there are three sizes—fifteen splints.

Fig. 4. "Straight hollow Splints for the Arm."

Several sizes—six splints.

Fig. 5. "Shoulder Splint, adapted to the top of the shoulder and outside of the arm. The joint is required to accommodate the cap or upper portion of the splint to the different positions of the shoulder."

Fig. 6. "Elbow Splints."

For Fractures near the Elbow. These splints are fitted to the two sides of the arm, and connected at the elbow by double hinges, which fix the arm at any degree of flexion or extension required, and the position may be changed by turning the screw, which serves also as a pivot for the hinge. The hinges may be easily transferred to splints of different sizes. The usual arm and forearm splints are used for this purpose.

(See Transactions of the American Medical Association, Vol. 9, p. 230; also, Hamilton on Fractures, &c., p. 250.)

## SPLINTS FOR THE INFERIOR EXTREMITY.

Fig. 7. "For Fractures of the Fibula, or inner malleolus of the Tibia, with displacement of the foot in the direction of the fracture, or for fracture of both Tibia and Fibula near the ankle."

For the treatment of these injuries the lower portion of the Adjustable Side Frame, plate II, fig. 1, is used. The lower side piece of each side of the frame attached to the flexible side splints by the connecting screws and foot piece, as here represented, is all that is required.

### PLATE II.

Fig. 1. "Adjustable Side Frame," for Fractures of the Leg.

This may be flexed or extended, and fixed in the position re-



quired by the hinges. This is done by means of pinion-like teeth at the circumference of the hinges, which are held in contact or separated, by screws, forming the pivots of the joints. It is fitted to limbs differing in length by sliding joints at the sides of the limb, and in the splint which supports the under side of the limb. The depth is increased or diminished by turning the screw at the bottom of the foot-piece.

Figs. 2 and 3. "Flexible Side Splints."

The side splints are moulded to the inside and outside of the leg, and are of three sizes—six splints. A straight hollow splint should be placed upon the thigh to support the thigh straps.

Fig. 4. "Thigh Apparatus."

a. "Upper extremity, broad and well cushioned, so as to rest easily against the side of the body. The breadth of this portion of the splint assists also in preventing its rotation. It is furnished with rings for the perineal band."

b. Brace for fixing a joint; to be used only in packing.

c. Screw for adjusting a sliding joint, for the purpose of lengthening or shortening the splint.

d. Thumb screw for making extension.

The hollow splints represented below, can be moved upon each other by a joint opposite the ham, and their position secured by a moveable bar. They may also be lengthened or shortened. There is a joint corresponding to the heel and another opposite the sole of the foot.

"The apparatus may be used as a double inclined plane, or as a straight splint."—*Transactions of American Medical Association*, Vol. 10, p. 432.

Fig. 5, 5, 5.—Straight hollow Splints for the Thigh, several sizes—six splints.

Fig. 6. A form of Gaiter, for making extension in Fractures of the Thigh.

## GENERAL DIRECTIONS FOR THE APPLICATION OF THE SPLINTS.

The splints, if not perfectly adapted to the surface, are first immersed in water as hot as can be borne by the hand, until they are sufficiently flexible; or, if more convenient, and only portions need to be changed in form, envelope either the entire splint, or such portions as may be necessary, in cloth wet with hot water. If water, at or near the boiling temperature, be used, some care is requisite that it is not continued so long as to completely melt the gutta percha, so as to separate the layers of veneers. Then a cloth, or if preferred, a very thin cushion of cotton batting, is laid on the splints, and they are fixed upon the limb by a bandage. For a bandage I usually prefer the roller, which is applied with more ease and uniformity, and gives better support to the muscles than the bandage of strips or Scultet's bandage. This is first bound upon the limb from the inferior portion of it upwards, the splints are then applied, and secured by the roller passed downwards over the splints. If it is afterwards desired to convert this into Scultet's bandage, as it may be, especially the portion of it which comes in immediate contact with the limb, divide the alternate turns with scissors at convenient distances, and they may easily be drawn to suitable positions on the limb.

A still lighter, and an effectual method of confining the splints, is by four or five tapes or straps passed through perforations or loops at the two sides of one of the splints, then doubled back, and tied or buckled over the loose splint. The splints being secured in this way, the bandage *over* the splint may be altogether omitted. Simple as this method of securing is, it is a valuable improvement, entirely preventing the sliding of the straps in any direction upon the splints, or any change in the position of the splints upon the limb. The straps for securing splints should never be allowed to pass around the limb, unless immovably attached to one of the splints.

## APPLICATION TO PARTICULAR FRACTURES AND INJURIES.

### Fracture of the Forearm.

For Fractures of the Radius, or Ulna, or both these bones together, the apparatus required is—

1. The Forearm Splints, palmar and dorsal.
2. Compresses, to be applied along the interosseous space.
3. The Roller.

After adjusting the bones, first apply the compresses to compress the muscles between the bones; then the roller, previously moistened, from the roots of the fingers to the elbow; after this, the splints; then complete the dressing by passing the roller downwards to the ends of the fingers. Or the method of securing the splints by tape or straps, as above described, may be adopted, then the bandage over the splints may be entirely omitted.

This method of dressing fractures of the forearm is at once simple, easy, light, and effectual in all cases, except where the fracture is seated very near the joints, either of the elbow or wrist; then other methods of maintaining the position of the bones are required.

### Fracture of the Radius near the Wrist, and Fracture with Dislocation of the small Head of the Ulna.

Next to the common form of fracture of the forearm, near the middle of the bones, the treatment of which is so simple and satisfactory, we are immediately met by one of the greatest annoyances in the entire range of fractures, being accidents of frequent occurrence, and annoying to the patient, because unavoidably painful, slow in recovering, the fingers and wrist remaining a long time stiff, and rotation of the hand difficult or permanently impaired, and sometimes, also, resulting in permanent deformity of the joint; and annoying to the surgeon, because it is difficult to persuade the patient that an injury so trifling in appearance is necessarily attended with consequences so serious.

Simple fracture of the radius at the lower extremity near the wrist, as it usually appears, when resulting from falls upon the hands with projection of the inferior portion on the back of the wrist, and corresponding projection of the superior portion anteri-

only, can only be mistaken for dislocation of the wrist backwards. If such a mistake occurs, and the case is relinquished after reduction, without mechanical support, the displacement quickly returns, and the deformity is as unsightly as before. A careful examination will enable the surgeon to easily discriminate the injuries. In fracture, rotation is particularly painful, and the displacement is increased by pressing the radius with the thumb in the palmar direction, while we rotate the hand outwards. The precise point of the displacement may be more accurately detected by flexion and extension of the hand. Too much reliance must not be placed on the absence of crepitation, as this symptom can only be produced by forcible extension with rotation of the hand, and sometimes not even then. It will usually be perceived at the time of replacing the fracture, and other attempts to produce it only occasion unnecessary pain. There are cases of this accident with only slight displacement, which, in the swollen condition of the parts, cannot be detected. The principal characteristic is, then, painful rotation, with the pain referred to this portion of the bone; but guided by this circumstance alone, subsequent developments will not often show the surgeon at fault in his diagnosis.

The difficulty in the treatment of this injury is greatly increased when complicated by either fracture or dislocation of the ulna, but especially by dislocation. Dislocation of the head of the ulna, from the radius, may occur also without fracture of the radius, but the fracture is much more commonly present. All these different forms of injuries are usually produced by the same cause, that is, falls upon the hand, and require essentially the same form of mechanical support for their treatment. The dislocation, whether complicated or simple, is known by the absence of the prominence on the outside of the wrist caused by the small head of the ulna, with a corresponding projection in the palmar direction, the head of the ulna lying nearly on a level with the os-pisiforme. This is the direction of the dislocation, at least in all the cases I have witnessed. When reduced, there is always great liability to displacement, owing to the small and superficial articulating surface of the radius. When there is also fracture of the radius, the tendency to displacement is increased by the strong action of the muscles of the forearm, and the difficulty of binding the head of the radius to the ulna, without compressing the superior fragment

so far into the interosseous space as to prevent rotation of the forearm, and occasion very considerable deformity of the wrist. In the worst forms of the accident there is much injury of the soft parts, followed by high inflammation and severe pain, which wholly preclude efficient bandaging until the inflammation has subsided. I have, in repeated instances, witnessed this form of injury occurring, to a greater or less extent, in both the wrists at the same time, by persons who, in falling from a height, and naturally projecting the arms to save themselves, have received the principal force of the fall upon the hands.

The treatment of these accidents is, it appears to me, but imperfectly considered in the books. Boyer remarks, concerning fractures of the radius near the wrist, that "There is always, in this case, a considerable swelling of the adjacent articulation, and afterwards more or less difficulty in its movements;" and in complicated fracture, "As we cannot foresee the period when we can apply the apparatus, and as at this time the bones may have united in an unnatural position, it is proper to advise the patient of the probable loss or difficulty in the action of pronation and supination."

So far as the difficulty in these cases arises from the difficulty of retaining the bones in their proper position, it may, I think, in all cases, be overcome, provided the necessary applications are made speedily after the injury is inflicted, before inflammatory action has commenced, and the patient will exercise any tolerable share of submission to the restraints imposed upon him.

The indications are, first, to secure absolute rest of the part, with the thumb pointing upward. 2. The ulna being regarded as the fixed point of support, the inferior portion of the radius is to be constantly and forcibly impelled toward it. 3. The head of the radius and hand, strongly abducted, are to be retained in their proper position in relation to the shaft of the bone.

The first and second of these indications may be fulfilled by means of what I have denominated the ulnar splint, in a former circular. See duplicate splints, p. 25. To simplify somewhat the dressing in these cases, we have constructed a single splint, in which is combined nearly the form of both the ulnar and palmar splints, fitted to the palmar and ulnar sides of the forearm, with the hand strongly abducted, making a more convenient, and, per-



haps, equally efficient mode of dressing. After replacing the bones and wrist, apply a sufficient compress along the ulna; after this, what I have called the wrist splint (Pl. 1, fig. 3) upon the palmar side of the arm, and the usual dorsal splint to the dorsal side of it, and secure these by straps or tapes, as described (*page 14*). The bandage may be then continued downward over the whole to the fingers. It is an improvement to bandage each finger separately, to prevent swelling, before commencing dressing the arm. I can assert the complete success of this method of treatment in numerous cases, and without any failure, where the prescribed directions have been complied with.

The rigidity of the tendons and stiffness of the fingers which harass the patient for so long a period after this injury, may be diminished, by early resorting to passive motion and frequent dressings, with frictions during convalescence.

#### Fractures of the Elbow-Joint.

This comprehensive and rather indefinite title is chosen, because all the injuries included by it are treated by the same form of apparatus, viz., the hollow-jointed elbow splints. (See Plate 1, fig. 6.)

These splints are adapted to the two sides of the arm, are capable of any desired change in regard to flexion or extension, are readily adapted to limbs differing in size or length, giving complete support to the joint, and thereby preventing all motion or displacement of parts; they are at once convenient and effectual, and the intention is so fully accomplished, by means so entirely simple, that there seems to be little room for more to be expected or desired.

#### Fracture of the Inferior Extremity of the Humerus.

Whether the fracture is oblique, separating either the internal or external condyle, or transverse, including both, or if with the last, as occasionally happens, a longitudinal fissure, extending from the transverse, through the cavities for receiving the olecranon and coronoid processes to the joint, separates both the condyles; in either case the apparatus consists of: 1. The hollow jointed splints for the outer and inner sides of the arm. 2. A compress and one or more rollers of sufficient length to extend

from the hand to the shoulder, including the necessary turns about the elbow, and then from the shoulder to the hand, including the splints. 3. If the fracture is transverse, with projection of the detached portion backwards, resembling dislocation of the elbow in that direction, a light narrow splint to extend from the point of the olecranon nearly to the shoulder.

*Manner of Dressing.*—This consists in first bending the arm, and when the fracture is transverse, drawing it downwards and forwards to effect a replacement of the bones: then applying the splint to the back side of the arm, and extending to the olecranon, with a proper compress resting upon the point of the bone. The arm is then held by an assistant, while the surgeon applies the rollers from the roots of the fingers to the shoulder, making several turns around the elbow. Then the side splints, fixed at the required angle, are placed on the sides of the limb, and the dressing is completed by continuing the bandage downward from the shoulder to the hand. If the condyles are fractured obliquely, with displacement of the forearm, either outward or inward, first place a compress on the round side of the limb, extending to the elbow; then place the arm on the splint fixed at the proper angle, and these being held by an assistant, the roller is applied from the fingers to the shoulder; then the other splint is applied, and the roller continued downward again to the hand. Lotions should be applied to prevent or reduce inflammation.

After the first week or ten days, changes should be made in the position of the arm at every dressing. These should be more or less extensive, according to the amount of inflammation existing at the time. The arm may in this way be gradually brought to the extended position, and then again to the flexed, and, by this means, the liability either to deformity or ankylosis is prevented.

#### Fracture of the Olecranon.

*Apparatus required.*—1. The jointed elbow splint fitted to the outside of the arm. 2. Three rollers, one to be expended on the forearm with a few turns about the elbow—the second to be passed from the top of the shoulder of the injured arm around the body under the opposite arm, to prevent the bandage slipping down; it is then continued from the top of the shoulder to the elbow. The last is used to confine the arm upon the splint. 3. A

compress and flexible hollow splint fitted to the back side of the arm. 4. Adhesive straps one and a half inches or more in width, and twelve or more in length.

*Method of Procedure.*—Extend the forearm, bring down the detached olecranon process in close contact with the ulna, and retain it in this position by the adhesive straps, one on each side of the arm, passing spirally and crossing immediately above the olecranon, and thence down upon the sides of the forearm, drawing downwards the detached portion of bone, to be held in this position by an assistant, while the surgeon applies the first bandage from the roots of the fingers to the elbow; the compress and flexible splint are then applied over the triceps and supporting the extremity of the olecranon, and then the second bandage is applied. After this the jointed splint is placed upon the arm, fixed in the extended position, and confined by the third roller, extending from the fingers to the shoulder.

As this injury is usually produced by direct falls upon the elbow, and attended with considerable contusion, it may be necessary for the inflammation resulting from this to subside before the apparatus can be efficiently applied. An obvious necessity exists for the splint on the back of the arm. The insertion of the tendon of the triceps muscle into the olecranon is such as to leave a considerable space at this point between the humerus and tendon; consequently, pressure directly upon the tendon must force it too closely inward, and by tilting the superior portion of the fractured bone upon the humerus, throw outward and separate the lower portion from its attachment to the ulna, leaving too great a space for bony union to be accomplished. Hence, in this fracture we almost uniformly have only ligamentous union, with some separation between the fragments, and “owing to this, the arm long remains weak, and sometimes never recovers its former strength.”—(*Prof. Gibson.*)

#### Fractures in the Middle or Body of the Humerus.

The treatment of these easily-managed fractures, which seldom result in deformity, scarcely needs explanation. Two splints (Pl. 1, fig. 5) may be applied to the back and foreside of the arm, and both secured in the usual manner by a roller; then two

similar splints may be applied to the outer and inner sides of the arm, and in like manner secured upon it by the bandage.

### Fractures of the Neck of the Humerus.

This fracture, though not difficult to manage, is but little benefited by ordinary splints, which, owing to the form of the part, and shortness of the detached fragment of bone, can give but little support. The splints always project, giving an unwieldy appearance to the dressings, and require the additional support of paste-board, leather, or other flexible material.

The form of splint here recommended for this fracture is original, forms a neat and convenient dressing, and fixes the bone in its proper position with great security and firmness. It is represented Pl. 1, fig. 7. No directions are required for its application, except that one or more turns of the roller should be continued from the top of the injured shoulder, around the body, under the opposite arm, to keep the dressings in place.

This form of splint is also well adapted to cases of delayed or non-union of fracture of the humerus. Here, it seems, the weight of the arm operating constantly to keep the portions of fractured bone separate, while the natural contractile tendency of the muscles to overcome any bandaging and compresses over the muscles, acts as a cause of non-union of the bones. This is a cause of this unfortunate result, more frequent in this than any other bone of the body, which has not before been pointed out, but I am confident will prove the true one. With this splint it is easy to maintain constant support, or, if need be, compression, in the direction of the shaft of the bone. The shoulder-cap is confined upon the shoulder, and prevented from sliding outward by a band passing from rings upon the cap of the splint, around the body, under the opposite arm. The arm being flexed, another band, with a compress or pad, is placed under the elbow, and secured by hoops or rings at the lower end of the splint; and this may be drawn with any degree of firmness to give the necessary support. A bandage, of the form of the figure 8, may also be applied from the top of the shoulder of the injured arm, around under the elbow to the top of the shoulder, under the opposite arm, and again to the top of the shoulder; and this may be repeated two or three times. In no



case may bandages be applied around the arm to confine it to the body except directly at the elbow. If higher on the arm it operates as a fulcrum over which the arm is liable to be bent at the seat of the fracture.

### Fractures of the Inferior Extremity.

It will be convenient here, as in the consideration of apparatus for the superior extremity, to commence with the more simple, these being the inferior portions, first. It is not necessary here to make comparisons between the apparatus described and a multitude of very excellent forms which have from time to time appeared and had their day, and have been superseded by others, or, as would now seem to be the tendency, by none at all. However others may regard the subject, I have no expectation that, in private practice at least, surgeons will often recommend to their patients, or that patients will be often found to submit to dole away their thirty, forty, or sixty days of absolute confinement in a prescribed position, without the relief of such changes of posture, and such movements of the body or limbs as can only be allowed where a good apparatus is used. With such help, experience has abundantly demonstrated that in many cases free motion, and in some almost unlimited exercise, may be safely allowed.

### Improved Apparatus for Fractures of the Leg.

These fractures may all be well and conveniently treated by either the form of apparatus represented, Plate II, fig. 1, and flexible side splints, figs. 2 and 3, or the improved Amesbury's apparatus, page 27. Both differ from any of the forms now in common use: Firstly, in the arrangement of the joint for the knee, by which flexion and extension of the limb may be performed without changing the relative length of the splint and the fractured bone. This is effected by a joint at the side, instead of under the knee, and as high on the limb as the centre of motion of the joint, giving a more extended motion opposite, corresponding to the ball and socket. This alone is of sufficient importance to give this apparatus a decided advantage over all others in which this circumstance is disregarded. To illustrate the absurdity of attaching the joint in the ordinary manner, under the knee, we have only to place



a common jointed measuring rule under the limb, with the limb flexed to a right angle, then extend the limb and the rule together, and it will be found that the relative length of the limb below the knee and the rule will have changed from one to two inches. The neglect of attention to this circumstance is, I do not doubt, often the cause of displacement of the bones, and shortening of the limb. Secondly, in fig. 1, the screw, which serves as a pivot for the joint, also fixes the joint in the position required, by means of pinion-like teeth at the circumference. Hence, we avoid the inconvenience of a projecting rod or screw under the knee, which is employed in all other forms of apparatus extending to the thigh, that have come to my observation. Thirdly, the sliding joints for adapting the apparatus to limbs differing in length, are, in one, placed under the limb, in the other at the sides, avoiding the encumbrance of a projection beyond the foot. Fourthly, the method of attaching the foot-piece to the main support, by which the depth of the instrument may be increased or diminished, and the foot raised or depressed, and by which also the different portions of the apparatus are connected, giving it firmness and strength without increasing the weight, are also original. All these improvements, as well as the material of which the flexible portions are constructed, I consider give to both these forms of apparatus a sufficiently distinctive character to be designated as new and improved.

In all cases where the fracture of the bones is situated above the middle of the leg, the support should extend to the thigh, and be capable of fixing the joint, though occasional changes in the position should be allowed.

*The method of dressing* is simple and easy. The limb having been prepared by the reduction of displacements or coaptation of the fractured bones, a roller is passed from the toes to the knee. The side splints, softened by hot water, are then adjusted to the limb, and secured by the bandage continued down again to the foot. The limb is now placed on the frame, slightly cushioned with cotton or folds of cloth to receive it, when it is secured in the proper position by the screw at the side of the foot-piece and the side straps, and the joint at the knee is also fixed at the degree of flexion required. At a subsequent dressing the bandage, or either portion of it, if preferred, can be converted, as before described, into a bandage of strips.

### Improved Apparatus for Fractures of the Thigh.

The apparatus for the thigh possesses all the advantages which have been shown to distinguish the apparatus for the leg, and is adapted either to the flexed or extended positions of the limb, as the practitioner may prefer, or the circumstances of the case may require. The ability to change the position of the limb, I regard, in some circumstances, as essential to success, and the only possible means of avoiding very serious deformity. This is true of some cases of fracture below the neck of the femur, but near the hip, and also of some cases of oblique fracture, near the knee. It is also important to be able to flex or extend the joints to some extent after union of the fracture is accomplished, during the period of convalescence. We may thereby very much diminish the protracted stiffness caused by fractures near the joints, when kept constantly in the extended position.

### Directions for Dressing Fractures of the Femur.

If, as is now frequently practised, adhesive straps are used for making permanent extension, the straps prepared with tapes or loop-holes at the lower extremity, by which they may be secured to the foot-piece of the apparatus, are applied, extending from near the knee, or near to a level with the bottom of the foot. A roller is now applied, commencing with the foot, and extending upward nearly to the fracture. Another bandage is secured by a few turns about the pelvis, and after proper adjustment and coaptation of the bones, is continued downward upon the thigh, connecting by a few turns with the first-mentioned bandage. Flexible splints of wood and gutta percha are now applied to the sides and top of the thigh, of the length of the thigh, and secured by the remaining turns of the bandage. A sufficient cushion of cotton or cloth being placed upon the double inclined plane or bed-splint, the limb is placed upon it, and the necessary extension made by means of the counter-extending perineal band and adhesive strap or gaiter, or both, as may be preferred; the whole is then secured by the straps passing around the limb, and a band around the pelvis.

## Duplicate Forms of Apparatus for Treatment of particular Fractures.

### ULNAR SPLINT.



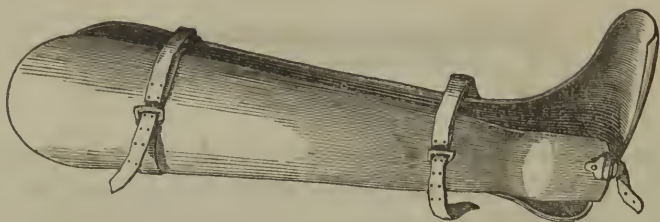
This splint is specially indicated in dislocations of the small extremity of the Ulna, and fracture of the Radius, near the wrist, or both these injuries combined. It is fitted to the outer or ulnar side of the forearm and hand, with the hand strongly flexed outward, and will be found an effectual method of dressing when other methods fail. It does not so far enclose the forearm as to enable us to dispense with the usual forearm splints when there is fracture of the Radius, and in connection with these splints is a more complicated form of dressing than the wrist splint—Pt. 1, fig. 3.

### The Longitudinal Half-Boot.

For the introduction of this form of splint we are indebted to the late Professor Nathan Smith, M. D., of Yale College. For all the important fractures of the leg, he required splints to be nicely carved from solid blocks of wood, to fit every particular case of fracture, which can only be well accomplished by an artist, at considerable expense, and the same splint will seldom serve for the treatment of more than a single case of fracture. This splint, and the mode of treatment adopted by Dr. Smith, are described in the *American Medical Review*, published at Philadelphia, A. D., 1825, vol. 2, p. 355. Splints of similar form, constructed of wood and gutta percha, may be adapted to limbs differing largely in size, and either to the inside or outside of the limb, as the case may require, and will serve for the treatment of many cases of fracture.

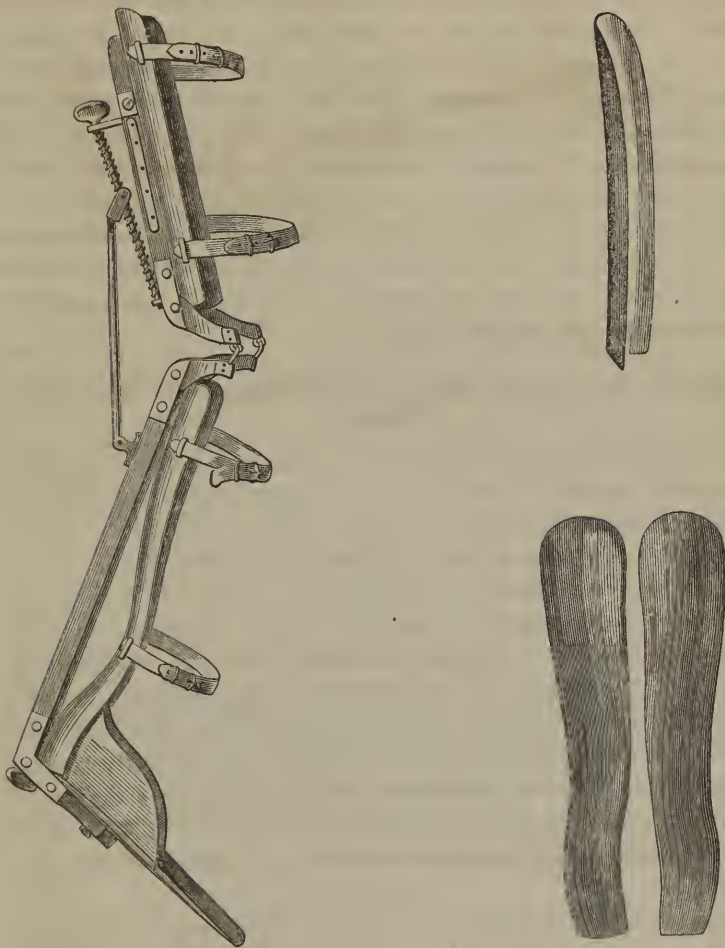
They are adapted to all cases of fracture of the inferior third of the leg. In fractures of the fibula, or inner malleolus of the tibia, we apply the splint to the side of the limb opposite the fracture, with a compress extending from the ankle-joint upward; then applying a roller from the toes to the knee, the splint is secured to the leg, and the foot is forced in the direction opposite to

the displacement. When both bones are fractured, the splint may in general be most conveniently applied to the outside of the limb.



We have substituted for the boot-splint the form of splints here represented, which is more easily constructed and fitted to the limb, and equally effectual in maintaining the position of the bones. It consists of two pieces. One is moulded to the form of the side of the leg and foot; the other is the common leg splint, outside or inside, as the case may require. These are connected by straps, as represented in the figure. This is a sufficient support for most of the fractures at the lower third of the leg. A roller is first applied from the toes to the knee, then the two splints to the two sides of the leg, protected by sufficient covering or padding upon the splints, and secured by straps passing through rings attached to the edges of one splint, and buckled over the opposite, as represented in the plate, and over these the bandage may be continued down again to the foot. If the fracture consists of fracture of the fibula, or internal condyle of the tibia, with dislocation of the ankle, a sufficient compress is applied to the sound side of the limb, extending as low as the joint, and secured by a bandage extending from the toes to the knee; then over the compress the splint with foot-piece, to prevent motion of the ankle-joint, and the common leg splints, to the opposite side; then these are secured by the straps and bandage, as before described, with sufficient turns of the bandage around the ankle to press the foot in the direction of the foot-piece of the splint.

## Improved Double-Inclined-Plane for the Leg.



This is a modification of Amesbury's Splint for fractures of the leg, with Roe's improvement in the method of making the splint adjustable to different sized limbs, which consist in having several splints of different sizes fitted to the under side of the limb, which can be connected to the main splint, or removed as required, by means of sliding joints or screws. It is here further improved by an original form of hinge corresponding with the knee, in which the centre of motion in the splint, when flexed or extended, corres-



ponds with that of the knee, and the limb can be flexed or extended with little or no change in the relative length of the limb and the splint. The splint can also be made longer or shorter to correspond with limbs of different lengths, or to make extension in dressing, by turning the screw at the heel; this does not make any projection of the splint beyond the foot. The brace for fixing the knee at the angle required, is regulated, as delineated in the plate, by a screw parallel with the thigh piece, or by a vertical screw and slide, as in Amesbury's Splint. The former has the advantage of making flexion and extension by a more gradual and uniform motion, when only slight motion can be allowed in consequence of inflammation or injury of the joint.

#### **Apparatus for Hip-Joint Disease and Fracture of the Neck of the Femur.**

The apparatus for fractures of the femur, before described, is peculiarly adapted to fracture of the neck of the bone. The apparatus specially intended for the treatment of this injury is valuable, as it enables us earlier to allow changes from the horizontal position and confinement to the bed, to sitting in a chair and exercise upon crutches—a matter of great importance in these protracted cases in aged persons, to whom the injury is principally confined. It consists of a splint fitted to the outside of the body and limb, extending from midway between the axilla and spine of the ilium to the bottom of the foot, and has joints corresponding to the joints of the limb, which can be fixed by means of the pinion-like teeth of the hinges at any degree of flexion or extension required, and has the usual means of maintaining extension and counter-extension.

The apparatus for the hip-joint disease of children is precisely the same in form, differing only in size, and is believed to be better adapted to maintaining perfect rest or allowing passive motion of the joint than any other in use.

#### **The Clavicle Adjuster.**

This is a modification of the writer's apparatus, described in the Transactions of the American Medical Association, vol. viii., p. 441; and "Hamilton on Fractures," etc., p. 197.

We have not space here for a further description, but give the

following testimonials just now received from G. B. Hawley, M. D., and P. W. Ellsworth, M. D.

Dr. WELCH,

*Sir* : The success with which I have applied your clavicle splint, has been gratifying to myself and a blessing to the patients; I most cheerfully recommend it to the profession.

Yours truly,

G. B. HAWLEY.

HARTFORD, CT., Feb. 12, 1861.

BENJAMIN WELCH, M. D.

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Dr. WELCH,

*Dear Sir* : I have used your apparatus for fracture of the clavicle but in a single case; that, however, was an unusually bad one. The failure of all other dressings to keep the parts in apposition, led me to try yours, as it appeared to possess a combination of qualities which I desired. The result was most happy; and I therefore cheerfully recommend the apparatus both for the perfection of its mechanical principles and the ease it is worn by the patient.

P. W. ELLSWORTH, M. D.

HARTFORD, CT., Feb. 12, 1861.

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## BUSINESS NOTE.

THE Apparatus and Splints here described, are manufactured by Welch, Seymour & Co., Lakeville, Litchfield county, Conn.; and the Splints being secured by Letters Patent of the United States, can be obtained only of them, or agents supplied by them. All orders accompanied by a remittance will be promptly attended to, and on the most reasonable terms.

LAKEVILLE, *Conn.*, Feb. 1858.

## EDITORIAL NOTICES.

*Notice by J. V. C. SMITH, M. D., Editor of the Boston Medical and Surgical Journal.*

**SURGEON'S SPLINTS.**—At Lakeville, Conn., is a manufactory of splints, made of alternate layers of wood and gutta percha, which recommend themselves at sight. They are extremely light, elastic, and moulded to fit every limb, and can be also readily adjusted to persons of different forms, size, or height. Even a permanent extension of the lower limbs is admirably maintained. Dr. B. Welch, the inventor, has fairly distanced all competitors, and furnished the surgeon with splints that meet all conditions of broken bones. There is a finish to them, quite unusual in such apparatus; and instead of being injured by use, there is no reason why a set of them should not last fifty years. In hospital as well as in private practice, it is presumed they will supersede all others now in use. By simply dipping one of them in warm water, it is instantly moulded to any shape required, and there it holds. Those parts which are designed for bracing joints, are curious, as individual specimens of mechanism, to assist nature in keeping injured parts in place, while the healing process is being accomplished.

*Opinion of Doctor E. H. DIXON.*

WE have received from Dr. Welch a complete set of this most scientific and satisfactory apparatus.

If we have occasion to revere the surgical science of England, France, and America, and to bow with reverence to their great teachers, what shall we say of the genius of our own countrymen, in applying the great practical principles they develop to the casualties of mechanic and rural life? The first tells us the great physiological principles which should guide us in attempting to save a limb, and the cautions to be observed ere we pronounce it incurable; the second gives us almost a living substitute from the work-bench! Scarcely have we been able to realize the wonder of the Palmer Leg, when Dr. Welch spreads before us, for every conceivable variety of fracture, the most beautiful and comprehensive apparatus that ever delighted the eye of the conservative surgeon, or the practical mechanic. The truth is, we lack words to express our admiration of it. Extremely light, wonderfully simple and adaptable, capable of elongation and shortening to any required extent, for every limb in the body—knee-caps, and elbow-joints, wrists, ribs, sternum, clavicles, and every other part, are kept in any required position, and accessible in a moment by loosing a single strap, while the inexpressible comfort of a change of position, even to mounting on crutches, is immediately attainable. All is as beautifully made, and as simple in its uses and adaptation as a gentleman's toilette case. A single box, one foot by two, contains the whole, and a beautiful and highly creditable essay on fractures, and some complete drawings of the mode of application, render the whole affair a most acceptable present, for which we return Dr. Welch our hearty thanks and congratulations. Many a limb will be saved by it from the amputating knife, when it is thoroughly known throughout the country.

EDWARD H. DIXON, M. D.,  
Editor of the "Scalpel," and Operating and Consulting Surgeon  
*Scalpel, Vol. V., No. 1, Nov., 1852.]* 42 Fifth Avenue, New-York.

*Opinion of D. MEREDITH REESE, M. D., LL. D., Editor of the New-York Medical Gazette.*

DR. WELCH'S SPLINTS and Apparatus for Fractures, announced in another column, are worthy of universal adoption, in lieu of any other before the profession. Their ingenuity and surgical adaptation to the purposes for which they are intended, should give them preference and patronage. They will be found invaluable for country physicians who often find it difficult to adjust and retain the fractured limbs of their patients, for want of the conveniences and appliances which are only attainable in the cities. By providing themselves with a complete set, they will be prepared to treat fractures in either of the limbs with facility and success. The whole apparatus ought to be possessed by every practitioner in city and country, since they are as indispensable in practice as are other Surgical instruments, and should be in readiness for emergencies.

The Judges for the late Fair of the American Institute awarded the medal to Dr. Welch for his meritorious improvements.

Dr. Welch, of Lakeville, Conn., has been making important improvements in his apparatus for fractures, &c., which, with his flexible splints, cannot fail to take precedence over all the cumbersome and complicated instruments heretofore in use.

*Opinion of S. W. BUTLER, M. D., Editor of the New-Jersey Medical Reporter.*  
Vol. vii., No. 7. July, 1854.

WELCH'S SPLINTS.—We have recently procured a set of these splints, the invention of Benjamin Welch, M. D., of Lakeville, Conn. We have, as yet, had no practical experience with them, but they possess features which commend them to the attention of surgeons. Their peculiarity consists in the combination of the firmness of woody fibre with the elasticity of gutta percha.

"The splints consist of light and elastic cases or coverings, formed of very thin strata or layers of wood, or 'cut veneers,' cemented together by interlayers of gutta percha, of such thickness as is required to maintain their form, and pressed into the form of the part for which they are designed. \* \* \* \*

"This may be introduced in any proportion required to give strength and durability and resistance to the action of fluids, and when properly applied, it adheres with more firmness to the wood than the fibres of the wood do to themselves. Another circumstance attending this arrangement, of considerable practical importance, is that the splints are made more flexible and elastic in the lateral or parallel direction of the fibres of the wood than in the longitudinal; hence, what may seem somewhat paradoxical, they readily accommodate themselves to changes in the dimensions of the limb, resulting from increase or diminution of inflammation, or from interstitial absorption, while they give perfect support to the injured or diseased part. When necessary to adapt them to limbs of individuals differing in the form and size of their limbs, they are made sufficiently flexible by immersion in hot water, or simply enveloping the splint, or such portion of it as may be necessary, in cloths wet with hot water for a few minutes, and then, on cooling, they will immediately become unyielding and elastic as before. This peculiarity can scarcely be too highly appreciated, for of all the materials heretofore proposed capable of being moulded to the part, and hardening after the splints are applied, none has been found which has not proved decidedly defective in practice. They possess great strength and durability, so that the same splint may be used a long time, and for the treatment of many cases of fracture. They do not preclude the use of evaporating lotions, water-dressings, or moisture, in any manner applied, except when heated much above the temperature of the body.



They are applied with great facility, rendering the dressings simple and easy to both surgeon and patient, and allow constant access to the injured part, to detect inflammation at its commencement, or any irregularity in the position of the bones; and after the tendency to inflammation has subsided, dressing or examination by the surgeon is required much less frequently than when ordinary splints are used. In short, they have combined with the property of being made sufficiently soft and yielding, to be moulded, with accuracy, to the surface of the part for which they are designed, all the properties of insolubility, lightness, elasticity, strength, and firmness, necessary to constitute a *perfect splint*."

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*Opinion of JAMES BRYAN, M. D., Editor of the Philadelphia Medical and Surgical Journal, Professor of Surgery in the Philadelphia College of Medicine, and in Geneva College, N. Y., &c.*

*Surgeons' Splints and Improved Apparatus for Fractures.* By BENJAMIN WELCH, M. D.

"The splints consist of light and elastic cases or coverings, formed of very thin strata or layers of wood, or 'cut veneers,' cemented together by interlayers of gutta percha, of such thickness as is required to maintain their form, and pressed into the form of the part for which they are designed. By this method of constructing splints, the fibres of the wood all run longitudinally or parallel with the surface, which gives them great superiority to splints carved from solid blocks of wood, however skilfully performed and fitted to the part; for when so thin as to be elastic, they are necessarily liable to split and break, and do not retain their form when wet."

These splints are very neat, flexible, and appropriate. Dr. W. has succeeded admirably in adapting his splints to the fractures of the humerus near the shoulder; of the olecranon process; of the bones of the forearm, particularly those of the distal third of the radius, and those of the thigh. The whole apparatus is light, neat, and strong. The style of ratchet designed to change the angle of the joints at the elbow and knee is very good. The splints appear to combine all the qualities of the flat or straight ones, with all those of the curved ones. (See Phil. Med. and Surg. Journal, Vol. I., No. 18.)

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*Opinion of S. H. POTTER, M. D., Professor of Surgery in Syracuse Medical College, Editor of the Syracuse Medical and Surgical Journal.*

WELCH'S FLEXIBLE GUTTA PERCHA SPLINT.—About one year ago I received through the agent of Dr. Welch, a full and complete set of his Surgeon's Splints, and, after applications of the different kinds, suited to every species of fractures, I am happy to assure my friends that they have, in every instance, proved perfectly satisfactory.

These splints are superior to others, from the fact that they are flexible, and readily moulded to every part of the human body where splints are required. Yet they are sufficiently substantial, so as to combine the character of a wet paste-board, in order to mould to the part, and at the same time be as substantial as the wooden splint. Dr. Welch has really manifested great ingenuity in the invention, and has made himself lastingly useful to his professional brethren. (See Syracuse Medical and Surgical Journal, Vol. vi., No. 11.)

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*Opinion of H. G. BEARDSLEY, M. D. Notice in Hamilton Reflector.*

DR. WELCH'S SURGICAL SPLINTS FOR FRACTURES.—I have just examined the celebrated flexible Gutta Percha Splints of Dr. Benjamin Welch, Salisbury, Connecticut.



They consist of a full set of splints for fractures of the arm and leg—are adapted to all ages and all conditions of fractures, and are the greatest improvement on splints of the age, and are so admirably constructed that they can be softened in warm water, and moulded to any part of the arm or leg, so as to fit exactly, and when they become dry are firm and unyielding, keeping the fractured end of bones in complete coaptation until union is effected.

By proper adjustment of these splints, in cases of fractures, there is no chance for bones to become displaced, causing deformities, as is often the case with other splints, and imperfect dressings.

Dr. Welch has contributed much to the cause of scientific surgery; and the profession, on becoming acquainted with his apparatus, and its mode of application, will doubtless appreciate its worth, by the use of it in their practice.

H. D. BEARDSLEY, M. D.

HAMILTON, N. Y., July 20, 1854.

#### FROM THE TRANSACTIONS OF THE CONNECTICUT MEDICAL SOCIETY.

John H. Welch, M. D., exhibited a Surgical Apparatus in the form of a fracture splint, the invention of Benjamin Welch, M. D., for the examination of the members of the Convention.

Whereupon Abram Talcott, M. D., S. T. Salisbury, M. D., and M. W. Wilson, M. D., were appointed a Committee to examine said splint, and report their opinion of the same to the Convention.

The Committee having made an examination of the Fracture Apparatus, made the following report to the Convention:

The Committee to whom were referred the examination of Dr. B. Welch's Fracture Apparatus, beg leave to report—

That they have attended to the duties of their appointment. That the apparatus is, in their opinion, a very ingenious and useful one, well calculated to answer the intention of its inventor, and eminently entitled to the confidence of the profession; and they recommend it to the favorable notice of the Medical Society.

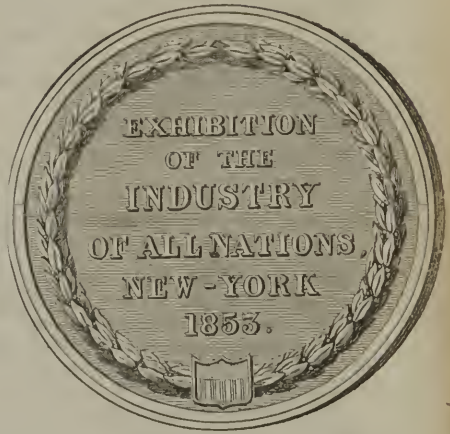
ABRAM TALCOTT, *Chairman.*

Report unanimously accepted.

(Attest)

J. G. BECKWITH,  
*Sec'y Con. Med. Society.*

MEDAL AWARDED BY THE ASSOCIATION FOR THE EXHIBITION  
OF THE INDUSTRY OF ALL NATIONS.



CRYSTAL PALACE, New-York, 1853.

The Medal of the Association was awarded to Dr. Benjamin Welch, for improvements in Surgeon's Splints and Apparatus for Fractures.

*Jurors:*

Prof. J. RENWICK, *Chairman.*  
Prof. ALONZO CLARK, M. D., *College of*  
*Physicians and Surgeons, N. Y.*  
Dr. GAILLARDET,  
Dr. ELLET,  
A. B. DURAND, Esq.,  
Prof. T. L. BUCKINGHAM,  
GEO. W. BLUNT, Esq.,  
Dr. PARKMAN,  
W. DARLING CAMPBELL, Esq.,  
Lieut. A. NOBLE, R. A.,

Prof. J. N. CARNOCHAN, M. D., *New-*  
*York Medical College.*  
H. R. KIMBERLEY, Esq.,  
Capt. Fox,  
Gen. T. S. CUMMINGS,  
Dr. E. G. LUDLOW,  
Prof. WILLARD PARKER, M. D., *College*  
*of Physicians and Surgeons, N. Y.*  
Dr. J. TRENOR,  
Dr. E. PARMLEY,  
Dr. C. E. ALLEN.

Dr. J. BRYANT SMITH,

*Acting Secretary.*

## MEDAL OF THE AMERICAN INSTITUTE.



The Judges for the Fair of the American Institute in New-York, A. D. 1852, in their Report, noted the Splints and Apparatus for Fractures as "highly meritorious," and awarded to Dr. Welch, for this improvement, the *Silver Medal* of the Institute.

*Judges.*

D. MEREDITH REESE, M. D., LL. D., *Late Physician to Bellevue Hospital.*  
 WILLARD PARKER, M. D., *Professor of Surgery in the College of Physicians and Surgeons, and Surgeon of New-York Hospital.*  
 Prof. C. R. GILMAN, M. D., *College of Physicians and Surgeons, N. Y.*

## MEDAL OF THE METROPOLITAN MECHANICS' INSTITUTE.

The Metropolitan Mechanics' Institute of Washington, D. C., presented to Dr. Welch their Silver Medal, in testimony of the merits of his Splint and Apparatus for Fractures.

## MEDAL OF THE CONNECTICUT STATE AGRICULTURAL SOCIETY.

The Connecticut State Agricultural Society, at their late Exhibition in Hartford, awarded Dr. Welch their GOLD MEDAL, for his improved Surgeon's Splints and Apparatus for Fractures.

## TESTIMONIALS FROM SURGEONS.

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*From* JONATHAN KNIGHT, M. D., CHARLES HOOKER, M. D., and P. A. JEWETT, M. D., *Professors in the Medical Institution of Yale College.*

NEW-HAVEN, Jan. 10th, 1855.

I have been acquainted with the Splints for fractures, prepared by Doctor Benjamin Welch, for two or three years past, and have frequently employed them in fractures. In the excellence of material of which they are composed, in their ready adaptation to limbs of various size and form, in their various contrivances to change the position of the limbs, while they remain applied, and in the means to keep up extension and counter-extension, when they are required, they seem to me to be more complete than any others which have fallen under my observation.

J. KNIGHT.

I fully concur in the opinion above expressed by Doct. Knight.

CHAS. HOOKER.

I cheerfully concur in the above.

P. A. JEWETT.

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*From* G. B. HAWLEY, M. D.

HARTFORD, Feb. 12th, 1861.

*Dear Doct.*:—I have used your Splints for the various fractures, with great satisfaction. The success with which they are applied, and the ease with which any part of the injured limb can be examined, without disturbing the other parts, highly recommend them to the profession.

Yours, truly,

G. B. HAWLEY.

BENJAMIN WELCH, M. D.

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*From* Professor VALENTINE MOTT, M. D., of New-York.

I have examined the apparatus invented by Doct. B. Welch, of Lakeville, Connecticut. In it is combined the splint of Amesbury and the seven principles of Boyer, for the lower extremity.

The splints are composed externally, of very delicate slips of wood, with gutta-percha between them. By this arrangement, when dipped into hot water, they become flexible, and will adapt themselves neatly to the parts.

He has adapted sets of them to the upper extremity also.

They are very cheap, and well adapted to all the various fractures of the upper and lower extremities.

VALENTINE MOTT.

NEW-YORK, Dec. 10, 1853.

*From Professor ROBLEY DUNGLISON, M. D., Philadelphia.*

*Dear Sir:*—The splints and apparatus, which you have kindly submitted to my inspection, appear to me to be admirably adapted to the purposes for which they are designed.

The material of which they are composed renders their adaptation easy; and the whole arrangement of the apparatus is such as to facilitate the treatment of an important class of surgical ailments.

I hope that the patronage of the profession will reward your brother for the time and ingenuity which he has bestowed on their construction.

I am, dear sir,

Yours truly,

ROBLEY DUNGLISON.

To Doct. JAMES WELCH,  
*West Winsted, Ct.*

*From Professor ACKLEY, Cleveland Medical College.*

I have examined Benj. Welch's improved Surgeon's Splints and apparatus for fractures, and have no hesitancy in stating that I consider them superior to any previously in use.

The whole apparatus constitutes an extensive variety of splints, and enables the surgeon to resort to all the various modes of dressing fractures, according to the necessity of each individual case.

H. A. ACKLEY, M. D.,

*Prof. Surgery, Cleve. Med. College.*

*Given at Cleveland,  
February 5, 1853.*

*From Professor GEO. C. BLACKMAN, M. D., Cincinnati, Ohio.*

BURNET HOUSE, Cincinnati, Dec. 27th, 1855.

I regard Welch's Splints with much favor, and employ them in the surgical wards of the Commercial Hospital, and in private practice.

They are of easy application, and, in my opinion, fulfil the indications in the treatment of fractures better than any other with which I am acquainted.

GEO. C. BLACKMAN,

*Professor of Surgery in Medical College of Ohio, and  
Surgeon of Commercial Hospital.*

*From Professor J. N. McDOWELL, M. D.*

ST. LOUIS, Missouri.

I have examined Welch's apparatus for fractures and dislocations, and think them valuable, and would advise the profession to obtain and use them.

With respect,

N. McDOWELL,

*Professor of Surgery, New University.*



*From Professor C. POPE, M.<sup>d</sup>D.*

ST. LOUIS, Feb. 26th, 1856.

I take pleasure in recommending Welch's Gutta Percha Splints, as from my experience in the use of the substance, they will most completely fulfil their intention.

CHARLES A. POPE.

*From Professor J. E. HAWLEY, M. D.*

ITHACA, N. Y., May 30, 1857.

MR. WILLIAM E. CHAPMAN:

*Sir*:—You desire me to give you my opinion of Welch's Splints. It affords me pleasure to say that I have been in possession of a set of them for some years, and that circumstances have required me to use something of this kind quite frequently, and that in all the emergencies that have demanded the use of such instruments, I have ever found them available, and entirely adequate to perform all that is claimed for them.

J. E. HAWLEY, M. D.,

*Late Prof. of Surgery in Geneva Medical College.*

I have used Welch's Patent Gutta Percha Splints in my practice, and consider them superior to any splint which is not flexible. I can cheerfully recommend them to all surgeons as being just the article they need.

GEO. W. SAXTON, M. D.

ITHACA, May 30th, 1857.

*From Dr. B. BONTECOU, M. D.*

TROY, N. Y., Oct. 1, 1853.

*Dear Sir*:—In answer to your inquiry, "how I like the splints you left with me," I cheerfully reply that I am very much pleased with them. They are so much preferable to any I have before met with, that I am using them to the entire neglect of all my old ones. Two cases of compound dislocation of the ankle with fracture, which I have recently treated on your skeleton splint for the leg, have satisfied me of the great convenience and beauty of the splint for severe injuries of that class.

R. B. BONTECOU, M. D.

TROY, N. Y., June 13, 1857.

*Dear Sir*:—I cheerfully consent to the use you propose making of my recommendation given some years since, for I could not speak too complimentary of your ingenious and useful apparatus.

Respectfully yours,

BENJ. WELCH, M. D., *Lakeville, Conn.*

REID B. BONTECOU.

*From Professor J. C. HUGHES, M. D., of Iowa University.*

KEOKUK, Iowa, June 13th, 1856.

*To the Profession:*—I have carefully examined the Surgeons' Splints of Dr. Welch, which are now being offered to the profession of this State by Mr. A. N. Poyneer, and find them admirably calculated to fulfil the want of the surgeon. Their easy applicability to the different cases gives them the preference over any splints which have been, and are now being offered to the profession.

J. C. HUGHES, M. D.,

*Prof. of Surgery, Medical Department, Iowa University.*

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*From Professor L. FREEMAN, M. D., Cincinnati, Ohio.*

This is to certify that I have carefully examined Welch's Patent Gutta Percha Splints, and find them better adapted to the purpose for which they were designed than any splints that I have ever used. Their flexible character, and apparent perfection is, indeed, a desideratum which surgeons have long desired. I have purchased a full set as my opinion of them.

L. FREEMAN, M. D.,

*Prof. of Surgery, Eclectic Medical Institute, Cincinnati, Ohio.*

CINCINNATI, Dec. 29, 1855.

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*From Doctors R. S. & O. E. NEWTON, Cincinnati, Ohio.*

CINCINNATI, Jan. 1st, 1856.

Having purchased, for the use of our office and Newton's Clinical Institute, a set of Doct. Welch's Surgeons' Splints and Improved Apparatus for Fractures, we take pleasure in stating that, after a careful examination of them, we find they are the most complete and best adapted to the purposes for which they are designed, of any similar articles we have ever seen, and therefore confidently recommend them to the profession.

R. S. & O. E. NEWTON.

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*From A. G. WALTER, M. D., Pittsburg, Pa.*

PITTSBURG, Sept. 29th, 1855.

I have examined the splints and apparatus of Doct. B. Welch, and am free to admit that they are destined to fulfil desiderata for which they are intended.

It has been the want, in Surgery, of materials which will shape itself when applied to the configuration of the limbs. Doct. Welch's splints are well adapted to supercede, in most cases, the use of splints of different materials, which heretofore have been in practice. For lightness and pliability they are unsurpassed.

The apparatus for fractured femurs I particularly commend. It is light, easily adjusted, and allows, when applied, more freedom of motion to the patient, without disturbing the extending and counter-extending force, than any other splint and apparatus which I know of. I have not yet had an opportu-

nity of trying the splints and apparatus, but feel confident that they will fulfil my expectations.

ALBERT G. WALTER, *Surgeon.*

Since writing the above, I have applied Doct. Welch's Splints and apparatus, and cannot but admire their construction, &c.

A. G. WALTER, *Surgeon.*

OCTOBER 1, 1855.

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*From* GEORGE DOCK, M. D., *Harrisburg, Penn.*

I have examined carefully Welch's apparatus for fractures, and consider it decidedly the most unique and valuable apparatus for the treatment of fractures that has come before me; while it fulfils all the desired objects in the dressing of a fracture, it possesses the quality of neatness and lightness, which make it more agreeable to the patient and less cumbersome.

I have purchased one of them, and can cheerfully recommend the article to the notice of the profession.

GEORGE DOCK, M. D.,  
*Harrisburg, Penn.*

AUGUST 1, 1855.

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*From* J. H. STEWART, M. D., *St. Paul, Minnesota.*

*My Dear Doctor:*—The splints arrived just in time to be applied to a fractured leg, and I never saw such *magical* results; they exceeded my expectations greatly.

Truly yours, &c.,

J. H. STEWART.

ST. PAUL, Minnesota, July 29, 1857.

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This will certify that I have been using Welch's Splints for the last eighteen months in my practice, and that I am satisfied of their great utility and convenience to the surgeon and general practitioner; and would recommend them to the favorable consideration of the profession.

J. J. CRAWFORD.

WILLIAMSPORT, Lycoming county, Pa.,  
July 6th, 1857.

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STEBENVILLE, O., January 10, 1860.

I have had in use in my practice "Welch's Splints" for the past four years, and believe them to be far superior to any other splint that has come under my observation. They are not only easily adapted to fractures, but are durable in their structure.

WM. STANTON, M. D.

EASTON, MD., Feb. 9, 1859.

I have carefully examined Doct. B. Welch's Fracture Apparatus, and have no hesitation in recommending it as superior to any other within the range of my knowledge and experience. Its prompt and admirable adaptability to every form of fracture renders it especially valuable to the country surgeon. I should certainly regard my own surgical appliances incomplete without Welch's Splints.

CHRIS. C. COX, M. D.,

*Ex-President of the Medical and Chirurgical Faculty  
of Maryland, and Oliver Professor Institutes of  
Medicine and Medical Jurisprudence in the Phil-  
adelphia College of Medicine.*

From Professors C. B. GIBSON, M. D., and A. E. PETTICOLOS, M. D., Virginia.

RICHMOND, May 13, 1858.

I have carefully examined Welch's Gutta Percha Splints, and believe they will completely fulfil their intention.

The splints for fracture of the lower end of the radius, for fracture of the anatomical neck of the humerus, and for fracture of the condyles, I regard as decided improvements.

CHARLES BELL GIBSON.

RICHMOND, May, 1858.

I have examined, with some care, Welch's Fracture Splints, and regard them as well adapted to their purpose. They are neat, light, and sufficiently strong, and so modelled as to meet most of the indications presented by fracture of the limbs.

The existence of a layer of gutta percha between the laminae of wood, of which they are composed, admits of their being moulded to suit individual peculiarities of form.

The metallic joints appear better fitted to give alteration of position without loss of extending power than those of any similar apparatus that I have seen.

A. E. PETICOLAS, M. D.

AUGUSTA, GA., April 4, 1859.

We have examined and purchased Welch's Fracture Apparatus, believing it to be superior to any other which we have examined.

ROBT. CAMPBELL, JR., M. D.,

*Demonstrator of Anatomy in the Medical College of Georgia.*

HENRY F. CAMPBELL, M. D.,

*Professor of Anatomy Medical College, Georgia.*

R. C. CARROLL, M. D.,

*Resident Physician, Jackson-street Hospital.*

AUGUSTA, GA., April 2, 1859.

I have examined the "Surgeon's Splints" devised by Doct. Benj. Welch, and find them remarkably well adapted to the purposes for which they are designed.

L. A. DUGAS, M. D.,  
*Professor of Surgery Medical College of Georgia.*

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From H. A. METTAUER, M. D., *Macon, Ga.*

MR. A. N. POYNEER:

*Dear Sir:* Having treated several cases of fracture with the set of "Welch's Splints" you furnished me, I can say, without hesitation, that they are the best instruments I have ever used. They are more easily applied than any others, less confining to the patients, fit the form of the limbs better. Indeed, in every respect, they, in my estimation, are greatly superior to any other splints now in use.

Yours, &c.,

H. A. METTAUER.

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COLUMBUS, GA., Jan. 27, 1859.

I have used "Welch's Gutta Serena Splints" for several years past, with great advantage in the treatment of fractured bones. They are durable and convenient, and applicable to many cases of fracture where the ordinary home-made splint is not adapted.

Country surgeons especially will find them useful, who do not always have the means of having suitable splints manufactured at short notice.

JAMES F. BOZEMAN, M. D.

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COLUMBUS, GA., Jan. 26, 1859.

This is to certify that we have used Welch's Gutta Serena Splints for the past three years. We have found them to answer a most excellent purpose in all the cases in which they have been applied. We think that no other splints are better adapted for the general treatment of fractures, and they are as durable as serviceable.

SCHLEY & DAVIS.

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COMMUNICATED BY A. N. POYNEER, AGENT, TRAVELLING IN THE STATE OF MAINE

PORTLAND (ME.), Sept. 13, 1860.

I have examined and purchased the splints made by Dr. Benjamin Welch, of Lakeville, Conn., and am very much interested in the principles involved in their construction, and am perfectly pleased with their material and mechanical structure. I think they will admit of more general application than any hitherto invented.

SIMON FITCH, M. D.



PORTLAND, Sept. 18, 1860.

Having examined the Gutta Percha Splints of Dr. Benjamin Welch, I am convinced of their excellence, and should prefer them to any other set I am acquainted with.

ISRAEL T. DANA, M. D.

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U. S. MARINE HOSPITAL, }  
PORTLAND, Sept. 17, 1860. }

This is to certify, that I have carefully examined Dr. Welch's Surgical splints, which are now being offered to the medical profession of this state, and I can cheerfully say, that they are in my opinion better adapted for the purpose for which they are intended than any splints or mechanical appliance that I have ever used. Believing this apparatus to be the best in all respects of any that are now in use, I have purchased a full set, and recommend them to the profession generally in this state.

S. H. TEWKSBURY, M. D.

I fully and cheerfully concur in the opinion above expressed by Dr. Tewksbury.

AUGUSTA, Sept. 25, 1860.

H. H. HILL, M. D.

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BATH, Sept. 19, 1860.

A. N. POYNEER:

*Dear Sir:* I have examined Welch's Apparatus for treating fractures, and consider it decidedly the best that has come under my observation.

A. J. FULLER, M. D.

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BRUNSWICK (ME.), Sept. 19, 1860.

I have thoroughly examined Welch's Gutta Percha Splints, and have been so much pleased with them as to purchase a set, though most liberally supplied with a variety from different manufactories.

JOHN D. LINCOLN, M. D.

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GARDINER (ME.), Sept. 22, 1860.

Mr. A. N. POYNEER:

*Dear Sir:* About four years ago I purchased a set of Welch's Surgical Splints, and have used them with entire satisfaction for fractures of the thigh, leg, arm, and fore-arm. Also for dislocation of wrist and ankle with fracture. I now use them to the exclusion of all others. I would cheerfully recommend them to the profession, as in my opinion superior to any other apparatus or appliance now in use for the same purpose.

Yours, very respectfully,

S. WHITMORE, M. D.





